

**SRM Institute of Science & Technology**

**Faculty of Engineering & Technology**

Ramapuram Campus

**UNIT V**

**PART A**

1. Monolithic integration for optical sources are confined to the use of

\_\_\_\_\_\_\_\_\_\_ semiconductors.

**a) Ⅲ-Ⅴ**

b) Ⅱ-Ⅲ

c) Ⅰ-Ⅱ

d) Ⅶ-Ⅷ

2. The OEICs realization \_\_\_\_\_\_\_\_\_\_ as compared to the other

developments in IO.

a) Scripted

b) Decreased

**c) Lagged behind**

d) Increased

3. Digital communication is suitable for

(a) low frequency application

**(b)large bandwidth application**

(c) long distance communication

(d)large wavelength application

4. Optical isolator is required to

**(a)pass light only in one direction**

(b)isolate electric field

(c) isolate magnetic field

(d)split the polarization

5.Doping helps to improve the

(a)stability

(b)resistivity

(c) mobility

**(d)conductivity**

6.Extrinsic semiconductors are

(a)semiconductor in its pure form

**(b)Doped semiconductors**

(c)semiconductor at fixed temperature

(d)semiconductor at constant pressure

7.Potential barrier in silicon is

(a) 0.3 V

**(b)0.7 V**

(c) 1 V

(d) 0.45 V

8.Current density in a n-type semiconductor depends on

(a) mobility of holes

**(b)mobility of electrons**

(c) magnetic field strength in the semiconductor

(d)polarization in the semiconductor

9. Which are the two main sources of noise in photodiodes without

internal gain?

a) Gaussian noise and dark current noise

b) Internal noise and external noise

**c) Dark current noise & Quantum noise**

d) Gaussian noise and Quantum noise

10. \_\_\_\_\_\_\_\_\_\_\_\_\_\_ is used in the specification of optical detectors

**a) Noise equivalent power**

b) Polarization

c) Sensitivity

d) Electron movement

11. The forbidden energy gap in semiconductors is approximately……….

a) 5 eV

**b) 1 eV**

c) 15 eV

d) 3 eV

12.Which category/ies of wavelength division multiplexer comprise/s two 3dB couplers where the splitting of an incident beam takes place into two fiber paths, followed by the recombination with a second 3-dB coupler?

a. Interference filter based devices

b. Angular dispersion based devices

c. Mach-Zehnder Interferometers

d. All of the above

ANSWER: (c) Mach-Zehnder Interferometers

13.Compositional and structural differences between photonic and electronic devices \_\_\_\_\_\_\_\_\_\_

a) Provide high efficiency

b) Provide low efficiency

c) Highly used

**d) Create problems**

14. To avoid large chip \_\_\_\_\_\_\_\_\_\_ devices are used.

**a) InGaAsP**

b) InGa

c) GaAs

d) InGaAs

15.\_\_\_\_\_\_\_\_\_\_\_ is useful for production of both planar micro-optical elements and stacked optical microsystems.

a) Wavelength amplifier

b) Wavelength convertor

c) Replication technology

d) Optical switching matrix

16.Devices operating at transmission rates greater than 40 Gb/s are \_\_\_\_\_\_\_\_\_

**a) GaAs and InP**

b) GaAs

c) InGa

d) InGaAs

17.HEMT based \_\_\_\_\_\_\_\_\_\_ have a spot-size converter with a photodiode.

a) p-n junction diode

**b) p-i-n photoreceiver**

c) IGBT

d) BJT

18.P-I-N photoreceiver based on HEMT is integrated with \_\_\_\_\_\_\_\_\_ guiding layers.

a) GaAs and InP

b) GaAs

c) InGa

**d) InGaAsP**

19.\_\_\_\_\_\_\_\_\_\_\_ is useful for production of both planar micro-optical elements and stacked optical microsystems.

a) Wavelength amplifier

b) Wavelength convertor

**c) Replication technology**

d) Optical switching matrix

20.Multilevel interconnections are incorporated in \_\_\_\_\_\_\_

**a) PIC**

b) AWG based coupler

c) Convertors

d) OEIC technologies

21.Optical fibre communications uses \_\_\_\_\_\_\_ dielectric waveguide structures for confining light.

a) Rectangular

**b) Circular**

c) Triangular

d) Planar

22.When the dimensions of the guide are reduced, the number of \_\_\_\_\_\_\_\_\_\_\_ also decreases.

**a) Propagating nodes**

b) Electrons

c) Holes

d) Volume of photons

23.The planar waveguides may be fabricated from glasses and other isotropic materials such as \_\_\_\_\_\_\_\_\_\_\_ and \_\_\_\_\_\_\_\_\_\_\_\_\_\_

a) Octane and polymers

b) Carbon monoxide and diode

c) Fluorides and carbonates

**d) Sulphur dioxide and polymers**

24.Strip pattern in waveguide structures is obtained through \_\_\_\_\_\_\_\_\_\_\_\_

**a) Lithography**

b) Cryptography

c) Depletion of holes

d) Implantation

25.Planar waveguides are used to produce \_\_\_\_\_\_\_ coupler.

**a) MMI**

b) CMI

c) Frequency

d) Differential

26.When both active and passive devices are integrated on a single chip, in multilayered form, then these devices are known as \_\_\_\_\_\_\_\_\_\_\_\_\_

**a) IP devices**

b) IO devices

c) Wavelength converters

d) Optical parametric amplifiers

27.Hybrid \_\_\_\_\_\_\_\_ integration demands \_\_\_\_\_\_\_\_\_ IP circuits to be produced on a single substrate.

a) IP, single-layered

b) IO, multilayered

**c) IP, multilayered**

d) IO, multilayered

28.When considering source-to-fiber coupling efficiencies, the \_\_\_\_\_\_\_\_ is an important parameter than total output power.

a) Numerical aperture

**b) Radiance of an optical source**

c) Coupling efficiency

d) Angular power distribution

29.It is a device that distributes light from a main fiber into one or more branch fibers.

**a) Optical fiber coupler**

b) Optical fiber splice

c) Optical fiber connector

d) Optical isolator

30.Optical fiber couplers are also called as \_\_\_\_\_\_\_\_\_\_\_\_\_\_\_\_

a) Isolators

b) Circulators

**c) Directional couplers**

d) Attenuators

31.The optical power coupled from one fiber to another is limited by \_\_\_\_\_\_\_\_\_\_\_\_

a) Numerical apertures of fibers

b) Varying refractive index of fibers

c) Angular power distribution at source

**d) Number of modes propagating in each fiber**

32.Which is the most common method for manufacturing couplers?

a) Wavelength division multiplexing

b) Lateral offset method

c) Semi Transparent mirror method

**d) Fused bi-conical taper (FBT) technique**

**33.**A four-port multimode fiber FBT coupler has 50 μW optical power launched into port 1. The measured output power at ports 2,3 and 4 are 0.003, 23.0 and 24.5 μW respectively. Determine the excess loss.

**a) 0.22 dB**

b) 0.33 dB

c) 0.45 dB

d) 0.12 dB

Answer: a

Explanation: Excess loss is a ratio of power input to power output of the fiber and it is given by Excess loss = 10log10 P1/(P3+P4)

WhereP1, P3, P4 = output power at ports 1,3 and 4 resp.

34.our-port FBT coupler has 60μW optical power launched into port one. The output powers at ports 2, 3, 4 are 0.0025, 18, and 22 μW respectively. Find the split ratio?

a) 42%

b) 46%

c) 52%

**d) 45%**

Answer: d

Explanation: Split ratio indicates the percentage division of optical power between the output ports. It is given by

Split ratio = [P3/(P3+P4)]\*100%

Where P3 and P4 are output powers at ports 3 and 4 respectively.

35.Calculate the splitting loss if a 30×30 port multimode fiber star coupler has 1 mW of optical power launched into an input port.

a) 13 dB

b) 15 dB

**c) 14.77 dB**

d) 16.02 dB

Answer: c

Explanation: The splitting loss is related to the number of output ports N of a coupler. It is given by-

Splitting loss (Star coupler) = 10log10N (dB).

36.A \_\_\_\_\_\_\_\_\_\_\_\_\_ \_ coupler comprises a number of cascaded stages, each incorporating three or four-port FBT couplers to obtain a multiport output.

**a) Star**

b) Ladder

c) WDM

d) Three-port

Answer: a

Explanation: A star coupler can be realized by constructing a ladder coupler. It consists of many cascaded stages. If a three-port coupler is used, then a ladder coupler does not form a symmetrical star coupler. It is a useful device to achieve a multiport output with low insertion loss.

37.A number of three-port single-mode fiber couplers are used in the fabrication of a ladder coupler with 16 output ports. The three-port couplers each have an excess loss of 0.2 dB along with a splice loss of 0.1 dB at the interconnection of each stage. Determine the excess loss.

a) 1.9 dB

b) 1.4 dB

c) 0.9 dB

**d) 1.1 dB**

Answer: d

Explanation: The number of stages M within the ladder design is given by 2M=16. Hence M=4.

Thus, excess loss is given by-

Excess loss = (M×loss in each 3-port coupler) + (Number of splices×Loss in each stage)

Where number of splices = 3 (as the value of M is equal to 4).

38.\_\_\_\_\_\_\_\_\_\_\_ is dependent upon the detector material, the shape of the electric field profile within the device.

a) SNR

**b) Excess avalanche noise factor**

c) Noise gradient

d) Noise power

Answer: b

Explanation: Excess avalanche noise factor is represented as F (M). Its value depends upon the detector material, shape of electric field profile and holes and electrons inclusion. It is a function of multiplication factor.

39.What is the abbreviation of HBT?

a) Homo-junction unipolar transistor

b) Homo-junction bipolar transistor

**c) Hetero-junction bipolar transistor**

d) Hetero-Bandwidth transcendence

Answer: c

40.\_\_\_\_\_\_\_\_\_\_\_ circuits extends the dynamic range of the receiver.

a) Monolithic

b) Trans-impedance

c) Automatic Error Control (AEC)

**d) Automatic Gain Control (AGC)**

41.What is generally used to determine the receiver performance characteristics?

a) Noise

b) Resistor

**c) Dynamic range & sensitivity characteristics**

d) Impedance

**PART B**

1.What is opto-electronic integration?

2. What are the challenges met by optoelectronic integrated circuits?

3. Define receiver sensitivity of photo receiver.

4.What is the need for integration of opto-electronic devices (8)

5. Explain briefly the application of opto-electronic integrated circuits(OEIC)

6.How Guided waveguides are formed?

7.Distinguish between Monolithic and Hybrid Integration

8.What are active guided wave devices and give example

9.Mention the types of integrated transmitter and receivers

10.Explain briefly about directional couplers.

11.What do you mean by front end Photo receivers?

12.What is the objective of OEIC?

**PART C**

1. With a neat diagram, Explain the performance of Front end photo receivers

2. Explain the noise and bandwidth considerations of the photo receiver

3. Explain the various steps involved in the fabrication of OEIC transmitter and also draw the equivalent circuit of integrated transmitter (16)

4. Explain the properties of optical guided waves and couplers.

5. Elaborate on the working of Mach zehnder Interferometers and comment on the applications.

6. Summarize the advantages, disadvantages, and applications of OEIC integration techniques

7. Discuss the materials and processing techniques of OEIC

8. Compare and contrast Hybrid and Monolithic Integration techniques.

9. Describe the working of PIN-HBT receivers with a neat diagram

10. Enumerate the importance of active couplers